

4. Check the voltage on the bridge circuit using a voltmeter with a resistance of at least 1,000 ohms per volt. With the bridge circuit closed, the normal potential difference should be approximately 1.5 volts. The voltage on the bridge circuit should always be kept between 1.45 and 1.75 volts. A low voltage on the bridge circuit could cause poor sensitivity of the recorder.

If the restoration of the sensitivity of the recorder cannot be accomplished by the methods listed above, follow the directions for removing other causes of a lack of sensitivity of the recorder to be found in the manufacturer's applicable book of instructions for operating and maintaining the calorimeter.

5. Check galvanometer suspension wires for proper size.

Split-scale instruments ----- 2-1/2 mill red tips  
Uniform scale instruments ----- 3 mill green tips

e. Restoration of Accuracy

1. Stop the tank unit drive motor and the recorder unit drive motor.
2. Remove the exit thermometer from the top of the return flow tube and clean the thermometer and/or burner jacket, if necessary.
3. Remove the burner jacket assembly, including the fluted tube, burner cap, inlet tube and combustion tube and clean all accessible parts.
4. Remove any excess water in the seal pot and in the base of the burner casting.
5. Remove the air-meter connector (inlet thermometer housing). Clean the thermometer and connector passages and replace the air-meter connector.
6. Remove the gas mixture connector assembly and the primary and secondary air orifice caps. Clean the orifice with a soft wood probe and replace the parts.
7. Replace the parts removed in Item (3) above, making sure that the top of the inlet tube is centered in the combustion tube and the combustion tube is centered in the fluted tube.
8. Replace the exit thermometer.
9. Start the tank unit drive motor.
10. Check the operation of the water pump. The pump bucket in the lowest position should just touch the bottom of the water reservoir. At the top of the stroke, the bucket should be empty.

11. Clean the water overflow weir. Use of a clean soft pencil eraser is recommended.
12. Examine the water level in the water tank and make sure that the water is flowing over the overflow weir.
13. Remove any oil that has accumulated on the surface of the tank unit mechanism, being very careful that no oil reaches the surface of the water. This is important because the accumulation of oil on the surface of the water will affect the efficiency of the overflow weir and the accuracy of measurement by the metering units.
14. Close the lid of the tank unit and start the recorder unit drive motor.
15. Check, and if necessary, adjust the "in place" mechanical balance of the galvanometer by placing the toggle switch located adjacent to the balancing rheostat in the "off" position and, with the recorder motor running, close the recorder door. When the galvanometer is in proper balance, the pen should draw a straight line. If the pen does not draw a straight line on the chart, adjust the knurled adjusting screw at the top of the galvanometer support until a constant chart reading is obtained for at least five minutes. Be sure to close the door of the recorder after each adjustment to prevent air drafts from causing a false deflection of the galvanometer.
16. Make a cold (electrical) balance test under the following conditions: the toggle switch (located adjacent to the balancing rheostat) in the "on" position, the recorder motor running, the recorder door closed, the calorimeter supplied with gas the bleeder flame burning, the main burner flame not burning, tank unit motor running, tank unit cover closed, tank water temperature, and ambient room temperature conditions in stable equilibrium, the cold balance setting unchanged from the operating setting last determined. Under these conditions the recorder pen should move toward and reach zero, or very near zero Btu scale reading in about 30 minutes. This test should be continued until the recorder pen has drawn a straight line on the chart for at least 30 minutes. If an exact zero reading is not obtained at the end of the latter 30-minute period, change the setting of the balancing rheostat by repeated steps in such a manner as to bring about a final zero scale reading for 10 minutes.
17. With the calorimeter being supplied with reference gas, light the gas at the main burner and close the lid of the tank unit. Wait for 50 to 60 minutes and observe the sensitivity and accuracy.

f. Preparation of a Recording Calorimeter for Determination of Theoretical Scale Reading of Reference Hydrogen Tank Gas and for Certification of Reference Gas

Immediately preceding the use of the recording calorimeter to determine the Theoretical Scale Reading for Reference Hydrogen Tank Gas or to certify the heating value of Reference Gas, the calorimeter must be checked and adjusted in compliance with all the instructions of this section in the order given and a complete record shall be made of all observations, adjustments, and results of the tests. These detailed instructions also must be used to the extent necessary to recondition and adjust a calorimeter at any time that the procedures of Rules 3.4d and e do not suffice to restore the accuracy of the calorimeter.

1. Air-Gas Ratio Checks and Adjustments

Check and adjust the air-gas ratio as specified in the manufacturer's applicable book of instructions.

2. Mechanical Balance

With the calorimeter supplied with a reference gas of constant heating value, and having drawn a straight line for at least 20 minutes, perform the following operations in the order given: Check and adjust the "in place" mechanical balance of the galvanometer by placing the toggle switch located adjacent to the cold balancing rheostat in the "off" position and, with the recorder motor running, close the recorder door. When the galvanometer is in proper balance, the pen should draw a straight line on the chart. If the pen does not draw a straight line on the chart, adjust the knurled adjusting nut at the top and to the left of the galvanometer support until a constant chart reading is obtained for at least five minutes. Be sure to close the door of the recorder after each adjustment to prevent air drafts from causing a false deflection of the galvanometer pointer.

3. Sensitivity Tests

Make a sensitivity test of the recording mechanism, in accordance with Rule 3.4c.

4. Restoration of Sensitivity

If the sensitivity of the recording mechanism as determined at the conclusion of the operation specified in Rule 3.4f3 above is outside the limits prescribed in the first paragraph of Rule 3.4d, perform the operations prescribed in Rule 3.4d.

5. Accuracy Tests and Adjustments

At the conclusion of the tests and adjustments specified in Item (4) above, the calorimeter may be changed from operation

on constant heating value gas to line gas after which the operations of Items (1) through (16) specified in Rule 3.4a shall be performed.

6. Preliminary Preparation for Hydrogen Test

- (a) Stop the recorder unit motor and then stop the tank unit motor.
- (b) Change the calorimeter from operation on line gas to operation on hydrogen gas generated from hydrone and arrange the supply piping to the instrument to convey gas to the orifice nipple through rubber tubing fitted with a screw clamp as indicated in Figure A.
- (c) Verify that the gas inlet orifice is a No. 70 drill size.

7. Hydrogen Test

- (a) Supply hydrogen generated from hydrone to the calorimeter.
- (b) Remove the bleeder burner and burn the excess hydrogen from the bleeder port.
- (c) Control the flow of hydrogen from the generator with the screw clamp to give a flame above the bleeder burner  $\frac{3}{5}$  to  $\frac{1}{3}$  inch in height.
- (d) Allow the instrument to operate until the pen has drawn a straight line for at least 30 minutes. Perform the sensitivity test as outlined in Rule 3.4C and observe and record the scale reading for each direction of approach. The average of these two readings will be the Btu scale reading for the hydrogen gas tested.

8. Theoretical Scale Readings for Standard Hydrogen Gas

The calorimeter scale reading to use when testing a calorimeter for accuracy by burning hydrogen generated from hydrone with the specified hydrogen test gears shall be the applicable value taken from the table on Theoretical Scale Readings on Standard Hydrogen Gas shown following or from the manufacturer's applicable book of instructions for the specific calorimeter under test.

THEORETICAL SCALE READINGS ON STANDARD HYDROGEN GAS\*\*

Calorimeter Range Btu/Cu. Ft.	Hydrogen Test Gears			
	20A-40B	24A-36B	27A-33B	28A-32B
150	80.0	106.5	130.7	139.8
200	106.5	142.0	174.3	186.4
300	159.8	213.1	261.5	279.7
450	239.8	319.6	392.2	419.4
500	266.3	355.1	435.8	466.1
600*	319.6	426.1	523.0	559.3
700*	372.8	497.2	610.2	652.5
900*	479.6	639.2	784.5	838.9
1,000*	532.6	710.2	871.6	832.2
1,200*	639.2	852.2	1,046.0	1,119.0
1,500	799.0	1,066.0	1,308.0	1,398.0
1,800	959.0	1,278.0	1,570.0	1,678.0
2,100	1,118.0	1,492.0	1,831.0	1,958.0
2,400	1,278.0	1,704.0	2,092.0	2,237.0
3,000	1,598.0	2,131.0	2,615.0	2,797.0

NOTE: \*For calorimeters which are to be used on butane-air mixtures, the tabulated values should be multiplied by 1.001.

\*\*The tabulation is for instruments calibrated to give results in Btu per standard cubic foot. (30" Hg-60° F. sst.) Test values for instruments designed to give results on a dry basis at standard conditions of pressure and temperature may be calculated by multiplying the above stated values by the factor 1.0177.

- Use of the split-scale recording calorimeter for determining the theoretical scale reading of reference hydrogen tank gas and for certifying reference gas.

The determination of the theoretical scale reading of reference hydrogen tank gas and the certification of reference gas shall be performed on a split-scale recording calorimeter.

- Required Operating Accuracy Using Hydrogen

If the scale reading from the recording calorimeter, as determined at the conclusion of the operations specified in Section F (8), does not differ by more than 0.5 per cent from the "Theoretical Scale Readings for Standard Hydrogen Gas," the calorimeter shall be considered to be in correct operating adjustment, requiring corrections to its scale readings of 0.5 per cent or less.

- Requirements for Changing Length of Baffle Tube

If the scale reading from the recording calorimeter, as determined at the conclusion of Rule 3.4f8 differs by more than

0.5 per cent from the "Theoretical Scale Readings for Standard Hydrogen Gas," Items (1) through (8) of Rule 3.4f shall be repeated in a further attempt to obtain the required accuracy. If there is continued failure to obtain the required accuracy and it is evident that the error is a result of incorrect heat exchange, rather than incorrect air-gas ratio adjustment or defective parts, change the length of Dimension "A," as shown in Figure E to correct the error.

g. Determination of Theoretical Scale Reading for Reference Hydrogen Tank Gas

Relatively pure hydrogen is available in cylinders and can be used for certification purposes.

Tank hydrogen is to be designated as "Reference Hydrogen Tank Gas" only if its heating value is equal to or is less than that of standard hydrogen gas by not more than 1/2 of 1 per cent.

Immediately after a recording calorimeter has been checked and adjusted as specified in Rule 3.4 f and its operating accuracy is in agreement with that specified in Rule 3.4 f 10, it may be used to determine the theoretical scale reading for reference hydrogen tank gas. The theoretical scale reading can be determined by use of the following equation:

$$\frac{\left( \begin{array}{l} \text{Btu scale reading} \\ \text{for Hydrogen} \\ \text{Tank Gas} \end{array} \right)}{\left( \begin{array}{l} \text{Btu Scale reading} \\ \text{for Standard} \\ \text{Hydrogen Gas} \end{array} \right)} \times \left( \begin{array}{l} \text{(Theoretical Scale)} \\ \text{reading for} \\ \text{Standard} \\ \text{Hydrogen Gas} \end{array} \right) = \left( \begin{array}{l} \text{(Theoretical Scale)} \\ \text{reading for} \\ \text{Reference} \\ \text{Hydrogen} \\ \text{Tank Gas} \end{array} \right)$$

After the pen has drawn a straight line for at least 30 minutes, perform the sensitivity test as outlined in Rule 3.4c and observe and record the scale reading for each direction of approach. The average of these two readings will be the Btu scale reading for the hydrogen gas tested.

h. Certification of Reference Gas

1. Immediately after a recording calorimeter has been checked and adjusted as specified in Rule 3.4f and its operating accuracy is in agreement with that specified in Rule 3.4f10 it may be used to determine the heating value of a suitable sample of reference gas for certification purposes. Allow the instrument to operate on the reference gas to be tested for certification until the pen has drawn a straight line for at least 30 minutes. Perform the sensitivity test as outlined in Rule 3.4c and observe and record the scale reading for each direction of approach. The average of these two

readings will be the Btu scale reading for the reference gas tested.

2. In order that adequate information concerning each cylinder of "Certified Reference Gas" be available at all times, the following information shall be entered on a form or in a log book provided for the purpose and also on a label or tag securely attached to each cylinder in which the gas is stored:

- (a) Serial number of the cylinder.
- (b) ~~Name~~ used to identify gas.
- (c) Date of tests to determine heating value for certification.
- (d) Identification number of recording calorimeter used for the certification test.
- (e) Heating value of the gas contained in the cylinder.
- (f) Pressure in cylinder after filling.
- (g) Source of gas contained in cylinder.
- (h) Date cylinder was filled.

i. Maintenance of Records re Certification of Reference Gas and Determination of the Theoretical Scale Reading for Reference Hydrogen Tank Gas

1. Substantiating records of all the tests performed by a gas utility in the preparation of a recording calorimeter for certification of a reference gas and for the determination of the theoretical scale reading of reference hydrogen tank gas shall be maintained for a period of two years after those gases were last employed for the testing of recording calorimeters of any gas utility.

## CHAPTER III

### RULES GOVERNING THE DESIGN, CONSTRUCTION, OPERATION, MAINTENANCE AND INSPECTION OF GAS HOLDERS AND LIQUID HYDROCARBON VESSELS

#### PART I - GENERAL

##### 1.1 General

These rules establish and prescribe a uniform procedure for the design, operation, maintenance and inspection of all gas holders and hydrocarbon vessels operated by public utilities in the State of Hawaii.

All of the provisions of these rules are mandatory except where, in certain instances it expressly appears that such provisions are but recommendation conforming to good engineering practice. The requirements contained herein should be considered as minimum and any utility may adopt additional safety rules and practices provided they are not inconsistent with the provisions of these rules.

##### 1.2 Application of Rules

The following rules shall apply to any person, firm or corporation now or hereafter engaged as a public utility in the business of furnishing manufactured gas, hydrocarbon gas, or any mixture of gases for domestic, commercial, industrial, or other purposes within the State of Hawaii where gas service is subject to the jurisdiction of the Public Utilities Commission of the State of Hawaii.

No utility shall be relieved from the express provisions of these rules without written authorization from the Commission. If hardship results from the application of any rule herein prescribed because of special conditions, application may be made to the Commission for a modification of such rule provided that no utility shall submit any modified procedure for the approval of the Commission which is contrary to any rule without submitting therewith a full and complete justification of such proposed procedure.

##### 1.3 Definitions

- a. The word "utility" and the term "gas utility" as used in these rules shall be construed to mean any person, firm or corporation engaged as a public utility in producing transmitting, distributing or furnishing manufactured gas, hydrocarbon gas, of any mixture of gases for domestic, commercial, industrial or other purposes.
- b. The word "Commission" as used in these rules shall be construed to mean the Public Utilities Commission of the State of Hawaii.
- c. The word "gas" as used in these rules shall be construed to mean manufactured gas. The term "hydrocarbon liquid" or "hydrocarbon vapor" shall refer to those compounds and mixtures



### 1.3. Definitions - continued

of compounds derived from petroleum or natural gas that exist in the gaseous state at normal atmospheric temperatures and pressure, but which may be maintained in the liquid state at normal atmospheric temperature by the application of suitable pressure.

- c. The term "holder" shall refer to any structure of five hundred cubic feet displacement or more, or which will contain ten thousand standard cubic feet of gas or more at the maximum design pressure, used for the storage at any pressure of manufactured gas, or hydrocarbon vapors. The term "low pressure" when used in connection with holders, shall refer to waterless and water sealed holders, while the term "high pressure" shall refer to all holders capable of storing gas at pressures in excess of those normally carried by waterless and water sealed holders.
- e. A "container" is defined as a length or lengths of pipe welded together with suitable end closures one or more of which may, with connecting piping, comprise a single holder constructed of pipe and fittings.
- f. The term "vessel" shall refer to any structure with a capacity of more than two thousand gallons used for the storage of hydrocarbon liquids but shall not refer to those vessels used for transporting purposes.
- g. The term "inert gas" is defined as a gas which will not burn or support combustion, such as nitrogen, carbon dioxide or mixtures of such gases.

## PART II DESIGN OF HOLDERS, VESSELS, HOLDER YARDS, AND VESSEL STATIONS

### 2.1 General Considerations

In the selection of a site for a holder or vessel, and in the design, construction, and/or installation of a holder or vessel, the following rules shall be adhered to:

- a. Holders should not be erected within 300 feet of public schools or other public assembly buildings with a seating capacity of over one hundred persons. Vessels should be erected as specified by the National Fire Protection Association Pamphlet No. 59, or as directed by the Fire Marshal's Office, State of Hawaii.
- b. All holders, vessels, and above ground piping and fittings adjacent thereto shall be properly surrounded by adequate fencing and gates that will prevent access by unauthorized persons.
- c. Except as herein otherwise provided, all electrical wiring and lighting within twenty-five feet of a holder or vessel shall be installed in accordance with the requirements of applicable

2.1 General Considerations - continued

Public Utilities Commission Regulations in the State of Hawaii, National Electrical Code for Class 1, hazardous locations, in effect at the time, and local County ordinances.

- d. No holder or vessel shall, without authorization of the Commission, be constructed or installed, the height of which is more than one twenty-fifth its distance from the nearest boundary of a licensed or lawfully established commercial or military aviation landing field. All holders or vessels shall be equipped with aviation beacons or warning lights as provided in Rule 3.1.1.
- e. Except as herein otherwise provided, it is recommended that all high pressure holders and liquid hydrocarbon vessels be constructed in accordance with the provisions of the American Petroleum Institute--American Society of Mechanical Engineers Code--Unfired Pressure Vessels for Petroleum Liquids and Gases, in effect at the time of the construction. Holders constructed entirely of pipe and fittings are not included in the foregoing Code and it is recommended they be constructed in accordance with the provisions of Section 2, "Gas and Air Piping," and Section 6, "Fabrication Details" of the American Standard Code for Pressure Piping, A.S.A. B31.1-1962. In consideration of the installation of all holders hereunder on land owned or under the exclusive control and use by the utility, such construction may be in accordance with either Division 1 or Division 2 of Section 2 of the same Code. All so-called bottle-type holders which are completely fabricated and tested in the manufacturer's plant shall be subject to the provisions herein which apply to holders constructed entirely of pipe and fittings.
- f. No utility shall construct or install a holder or vessel above ground or underground within fifty feet of a flammable building or adjoining property that may have a flammable building built thereon in the future, or from the nearest rail of a track on a railway private right of way provided, however, that a high pressure holder designed in accordance with Division 2 of Section 2 of said American Standard Code for Pressure Piping shall be installed as specified in A.S.A. B31.8-Standards for Gas Transmission and Distribution.
- g. When a holder or vessel is constructed adjacent to any existing high voltage electrical transmission line it shall be located no nearer the lines than the height of the poles carrying them. For the purpose of this Order a high voltage electrical transmission line is defined as one normally carrying voltages in excess of 50,000 volts.
- h. A recording pressure gauge shall be installed at the inlet or outlet of each high pressure holder, except that where a group of high pressure holders are jointly connected and are all filled from the same gas source and all empty into a common line or system,

2.1 General Conditions - continued

only one gauge will be required. A pressure gauge will be required on each vessel.

- i. The utility shall retain in its files any certificates of test and approval of vessels issued by said State Fire Marshal.
- j. At locations where flammable buildings, dwellings, or materials are located within 100 feet of vessels or above ground holders, hydrants shall be provided within sufficient proximity for use in case of fire, except where such stations are sufficiently close to rivers or other sources of water, and pumping equipment for such water is provided.
- k. Except as herein otherwise provided, it is recommended that all high pressure holders and liquid hydrocarbon storage vessels be protected by pressure relieving safety devices as set forth in the American Society of Mechanical Engineers Code referred to in 2.1e above and NFPA No. 59., except that rupture discs shall not be permitted to serve such purpose.

Except as herein otherwise provided, it is recommended that the location of stop valves between the pressure relieving devices and the holder or vessel, the capacity of the pressure relieving devices, and their methods of discharge be in accordance with A.S.A. B31.1-1962-Paragraphs 4G--132, 133 and 134. All pressure relieving devices on high pressure holders shall be tested after installation and before being placed in service to determine if they are in good operating conditions.

- l. All hydrocarbon vessels shall be provided with a liquid level gauging device as required by NFPA No. 59.
- m. Whenever a holder or vessel is to be partially or wholly buried underground, that portion exposed to the soil shall be reasonably protected against soil corrosion. Protective coverings and cathodic protection are commonly employed to minimize external corrosion. Dehydration of the gas is one means of preventing internal corrosion. Records of analyses of gas stored in holders should be maintained. Coupons placed in the gas flow are considered a guide in determining the need for internal protection. Buried coupons and periodic examinations and tests are means of determining the effectiveness of cathodic protection of the exterior of the holder.
- n. Each container comprising holders constructed entirely of pipe and fittings shall be given a hydrostatic pressure test after fabrication and before operation. Containers designed in accordance with Divisions 1 and 2 of the American Standard Code for Pressure Piping (A.S.A. B 31.1-1962) shall be hydrostatically tested to a hoop stress equal to 1.5 and 1.2 times the designed operating stress, respectively.

PART III  
HOLDER AND VESSEL OPERATION AND MAINTENANCE

3.1 General

The provisions of this rule shall apply to all equipment existing at the time of the effective date of this Order and to all equipment constructed or put into operation thereafter.

- a. The operation and maintenance of all gas holders and storage vessels shall be under the supervision of competent engineers or supervisors designated by the responsible operating official.
- b. In selecting man for supervisory work at holder or vessel yards, consideration should be given to their carefulness, thoroughness, reliability, and ability to assume responsibility in time of emergency. No person shall be delegated responsibility about a holder yard until he has been thoroughly acquainted with the nature of the work through training.
- c. All leaks of any consequence in gas piping, valves and equipment in the vicinity of a holder or vessel must be promptly repaired upon discovery, or as soon as practicable. All hazardous leaks must be remedied at once.
- d. Except under emergency conditions, all repairs and construction work in the holder or vessel yards shall be under the direction of the supervisor in charge. Permission to proceed with such work shall be granted only after he has fully verified that all necessary precautions against fire and explosion have been taken.
- e. The use of welding equipment on holders or vessels containing inflammable gases or liquids shall be permitted only after permission has been granted by the proper operating engineer and after he has verified that all necessary safety precautions have been taken to prevent fire or explosion.
- f. Persons working on holder, vessels, or adjacent piping, shall not smoke or be allowed the use of open flames or any other device that might bring about the ignition of gas escaping from a holder or vessel, except as otherwise provided in 3.1e above.
- g. All utilities shall make a conscientious effort to have an understanding with local fire departments as to procedure in case of emergencies involving holder stations. Such understanding should include, among other things, the utility obtaining from the fire department, preferably in the form of drawings or maps, the location of all fire hydrants and fire fighting equipment within a reasonable distance of the various stations. This information should be available to the station operators at all times.
- h. Before work is performed on any holder or hydrocarbon vessel which might bring about the admission of air to the holder or vessel, such as removing from service for internal inspection,

### 3.1 General - continued

internal repairs or dismantling, all inlet and outlet gas connections, except those opening to the atmosphere, shall be physically removed and the vessel purged with inert gases before the work is begun. The closing of inlet and outlet valves or the blanking off of inlet and outlet flanges shall not be considered sufficient precaution against the formation of an explosive mixture while the vessel is out of service.

1. Before work which might bring about the admittance of air is performed on a hydrocarbon vessel, all possible liquid shall be drained therefrom before purging is begun. A sufficient quantity of steam, water, or inert gases shall be used for purging in order to assure the removal of all hydrocarbon vapors before the admittance of air. Before workmen are allowed to enter a vessel removed from service and purged with inert gases, the inert gases shall be purged with air, or in lieu thereof, the workmen entering the vessel shall be equipped with supplied-air respiratory masks to which air is delivered under pressure, as approved by the U.S. Bureau of Mines. In addition, before workmen without respiratory masks and equipment are allowed to enter a vessel or holder from which the inert gases have been purged with air, a test shall be made of the internal atmosphere by suitable means of analysis to detect the possible presence of a dangerous concentration of carbon monoxide. When the interior of a holder or vessel that has been removed from service and purged of flammable vapors is scraped, brushed, sprayed, painted, or otherwise worked on in a manner that might bring about the formation of an explosive mixture of the confined air and dust or volatile vapors, a continuous and adequate circulation of outside air through the holder or vessel by means of fans or other device shall be employed.
2. The circulation of air shall continue until the person in charge of the work is convinced that there is no reasonable probability of the formation of such an explosive mixture. While engaged in such work, workmen should in addition, if conditions warrant, be provided with respiratory masks, as described above, to which air is delivered under pressure.
3. Upon returning a purged holder or vessel to service, the air shall be purged therefrom with inert gases before gas or liquid is allowed to re-enter the vessel.
4. All tests to determine the presence or absence of an explosive mixture in connection with the purging of a holder or vessel with inert gases or air, shall be conducted by competent operators by means of gas analysis apparatus or two explosimeters. When gas analysis apparatus is used the operator shall make sure the solutions are fresh and all parts of the apparatus are in good working order. If the tests are made by explosimeters, duplicate tests shall be conducted with two machines,

### 3.1 General - continued

both of which have recently been checked against gas mixtures of known composition.

5. Except as herein otherwise provided, it is recommended that all operations set forth in this Rule 3.1h, including gas analyses, be performed in accordance with the latest procedure recommended by the American Gas Association in its bulletin, "The Furging of Gas Holders."
- i. All persons employed in a supervisory capacity in holder or vessel operation and maintenance shall be provided with a personal copy of this Order and be required to be thoroughly familiar with its contents.
- j. Holder and vessel yards shall be kept clear of weeds, trash, papers, and other combustible rubbish, for a minimum distance of fifty feet from any holder vessel.
- k. At each high pressure holder yard there shall be placed in a conspicuous place, preferably near the operator's desk or panel board, a placard which tells the maximum safe working pressure of each holder or storage vessel.
- l. Aviation warning lights will be installed on holders as may be required by the United States Federal Aviation Agency.
- m. Wherever a waterless or high pressure holder or a vessel is painted, all seams on that portion of the holder or vessel being painted, which are subject to gas pressure, shall be inspected for leaks at the time of painting.

### 3.2 Water Sealed Holders

- a. Stairways and ladders of water sealed holders shall be kept clear for use at all times.
- b. Guides and rollers shall be kept well greased.
- c. Water or oil used for seals shall be kept at a suitable depth to prevent unsealing.
  1. Excessive amounts of oil or other protective mediums shall not be allowed to remain on the exterior surface of water seals.
- d. Tanks shall be kept free of rubbish.
- e. The operator of water sealed holders shall be observant of any wear or operating irregularities that might be indicative of faulty design, settlement of foundations, or other indications of trouble or failure.

### 3.3 High Pressure Gas Holders

- a. All valves, fittings, regulators, and pressure relief devices shall be kept in working order and reasonably protected from trespass.
- b. The maximum safe operating pressure of the holder shall be known to the operator, recorded as provided in Rule 3.1k, and not exceeded except in emergency and with the full knowledge and approval of the proper operating executive of the utility. It is recommended that the maximum safe working pressure be determined in accordance with the provisions of the American Petroleum Institute--American Society of Mechanical Engineers Code--Unfired Pressure Vessels for Petroleum Liquids and Gases, in effect at the time.
  1. The maximum safe working pressure of holders constructed entirely of pipe and fittings should be determined in accordance with said American Standard Code for Pressure Piping.
- c. All drips and drain lines shall be kept free of obstruction and in proper working order at all times.

### 3.4 High Pressure Liquid Hydrocarbon Vessels

- a. Except as herein otherwise provided, all vessels of this type shall be maintained and operated in accordance with the National Fire Protection Association, Pamphlet No. 59., or as directed by the State of Hawaii Fire Marshal. However, no reconstruction of vessels is required in order to comply with said Regulations if the vessels were acquired prior to December 31, 1964.
- b. All valves, fittings, regulators, and pressure relief devices shall be kept in working order and reasonably protected from trespass.
- c. The maximum safe operating pressure of the vessel shall be known to the operator, recorded as provided in Rule 3.1k, and not exceeded except in emergency and with the full knowledge and approval of the proper operating executive of the utility.
- d. All drips and drain lines shall be kept free of obstruction and in proper working order at all times.
- e. In order to provide for liquid expansion with temperature, liquid hydrocarbon storage vessels shall not be filled to a greater fraction of their volumes than is permitted by the National Fire Protection Association Standards, in effect at the time.
- f. At stations where equipment is employed for vaporizing the gas the vaporizer shall be located outside of buildings except those buildings devoted exclusively to gas manufacturing and distribution

### 3.4 High Pressure Liquid Hydrocarbon Vessels - continued

operations. Such buildings shall be of approved fire-proof construction and well ventilated from points near the floor and roof.

1. Any device supplying the necessary artificial heat for producing the steam, hot water, or other heating medium for the gas vaporizers shall be equipped with a full safety shutoff control. When such devices are located under a common roof with the gas vaporizers they shall be located in a separate compartment or room, which shall be separated from compartments or rooms containing liquefied petroleum gas vaporizers, pumps or central gas mixing devices by a fire wall containing no opening through which free vapors might flow. In the case of vaporizers employing artificial heat they shall be provided with a safety relief valve of adequate capacity at or near the outlet of the vaporizer. Direct-fired hydrocarbon vaporizers and heaters shall only be allowed after special authorization has been granted by the Commission.

## PART IV - INSPECTION PROCEDURE

### 4.1 General

The provisions of this rule shall apply to all equipment existing at the time of the effective date of these rules and to all equipment constructed or put into operation thereafter.

- a. After the effective date of these rules holders and vessels shall be completely inspected as outlined under the applicable provisions of Rules 4.2, 4.3, and 4.4, hereafter, at time intervals designated therein, dating from the last complete inspection.
  1. In order for a utility to receive acceptance from the Commission of a complete inspection, the utility must furnish complete copies of the reports of the inspections and also satisfy the Commission that all repairs incident to placing the holder or vessel in a safe operating condition have been made.
- b. Each utility shall employ a standard set of inspection forms prescribed by the Commission for recording data obtained at the time inspections are made. Copies of all forms shall be filed with the Commission.
  1. Complete copies of all inspections are to be kept on file by the utility for a period of at least three years. Copies of all annual general inspections and inspections covering longer intervals of time are to be kept on file by the utility as long as the holder or vessel remains in existence.
- c. Routine daily, weekly, monthly, and quarterly inspections of equipment may be made by the regular station operators. Where the



#### 4.1 General - continued

utility system consists of more than one property the annual general inspection of equipment should be made by a supervisor or engineer from the head office or a competent outsider.

- d. The monthly and annual inspection reports for all holders and vessels shall contain a general summary of the operating condition of the holder or vessel, and indicate any changes, repairs, or improvements that appear advisable.
- e. The annual general inspection report of each holder and vessel shall include a description and typical analysis of the gas or gases stored therein during the past year. Analyses shall particularly indicate the content of hydrogen sulphide, carbon dioxide, oxygen, and other corrosive impurities.
- f. Whenever the internal inspection of a holder or vessel is contemplated, it shall first be removed from service and entered in accordance with the provisions of Rule 3.1h.

#### 4.2 Water Sealed Holders

- a. The following minimum inspections shall be made and recorded:

1. Weekly:

- (a) Note general condition and inspect any parts requiring attention.
- (b) Check depth of water in cups.
- (c) Empty inlet and outlet drips. Note general conditions of lifts, tank water, guides and rollers. Observe water overflow.
- (d) Inspect beacon lights.

2. Quarterly:

- (a) Check lubrication of guide rollers, check paint, preservative on side plates, cleanliness of balconies, stairways, and condition of safety equipment. Without interference to regular operation of holder, observe for corrosion and indication of leaks such as rust spots, odors, and blowing of gas. Determine if guide rollers track properly and if guide roller frames have sufficient clearance from guide columns. Determine if an excessive amount of protective oil has collected on water in cups and if cups are free of rubbish and sediment.

3. Annual General Inspection:

- (a) General external inspection of holder paint condition and indications of corrosion. Note condition of holder framework. Leak tests shall be made on all portions of the

#### 4.2 Water Sealed Holders - continued

holder subjected to gas pressure; portions of holder ordinarily submerged during operation shall be tested by lowering lifts into water and observing for bubbles; portions of holder subjected to gas pressure that are not submerged in regular operation may be checked for leaks by other methods. All leaks and their disposition shall be recorded on the report forms. Remove external condensates and other corrosive deposits from the holder framework, tank or crown. Check holder cups for corrosion at the water line. Clean cups of dirt, rubbish, leaves, ashes and other foreign matter collected in them. Check plumb of guide framing, guides and guide rollers for clearance, alignment and wear. Rollers shall not improperly bind on guides. Test holder water for hydrogen ion concentration by an approved quantitative method.

#### 4. Additional Inspections:

After a water sealed holder has been in service for a period not to exceed twenty years, and at intervals not exceeding twenty years thereafter, a complete and thorough external inspection shall be made and reported upon by competent outside inspectors not regularly in the employ of the utility who are selected by the utility and are agreeable to the Commission. The condition of the crown, side plates, rollers, permanent frame shall be determined. Crown plates and side plates shall be checked for corrosion by non-destructive testing, cutting plugs, or drilling holes. Crown seams should be given particular attention. If, as a result of the external inspection, the inspector's report asserts the condition of the holder is such that an internal inspection is advisable, the holder shall be removed from service, dewatered if necessary, and a complete and thorough internal inspection made; provided, however, that should the utility not concur with the inspector's recommendation for an internal inspection, the matter may be submitted to the Commission for final decision.

- a. The utility may, if it desires, voluntarily have an internal inspection made in addition to the required external inspection. If such an internal inspection is made, the utility shall be relieved of the requirement of cutting plugs, from boring holes in, or non-destructive testing of the crown plates and side plates to observe for degree of corrosion, unless the results of the internal inspection indicate they are warranted.
- b. Details of what shall constitute these inspections will be found set forth in the inspection forms prescribed by the Commission. The person or persons making such inspections shall submit a complete report of the condition of each holder to the company and at the same time forward a copy to the Commission. When such holders as are inspected are found to be in a defective and hazardous condition they

#### 4.2 Water Sealed Holders - continued.

shall not be returned to service until repaired and placed in a safe workable condition. In the years that the inspections described above are made, the utility will not be required to make the regular annual general inspection.

#### 4.3 High Pressure Gas Holders

a. The following minimum inspection shall be made and recorded:

##### 1. Monthly:

- (a) Check by actual operation the working condition of all valves, regulators and other automatic equipment, except relief valves.
- (b) Check expansion rollers, gauges, and other equipment. Inspect and operate drips.

##### 2. Annual General Inspection:

General inspection of holder for condition, indications of corrosion and condition of paint. Check yard for cleanliness and fencing. Test all connections, manholes, and fittings on holder for leaks with soapsuds. All leaks and their disposition shall be shown on the report form. Determine if relief-device shutoff valve (if any) is locked open.

- (a) Check by actual operation all relief equipment and all automatic features pertaining thereto.
- (b) An examination shall be made of foundations and supports to ascertain if all saddles and piers are fully supporting the holder. Any settlement which will produce uneven and excessive strain shall be corrected at once.

##### 3. Additional Inspections:

Except as hereinafter provided, after a high pressure holder has been in service for a period of ten years, and at intervals not exceeding ten years thereafter, a complete and thorough internal and external inspection shall be made and reported upon by competent outside inspectors not regularly in the employ of the utility, who are selected by the utility and are agreeable to the Commission, with the following exception:

- (a) At locations where groups of two or more holders other than holders constructed entirely of pipe and fittings, exist, of the same type of materials and design, built at the same time and subjected during the interval to identical service conditions, no less than twenty per cent, nor less than one, of the holders in any such group shall receive the internal inspection after each ten years of service. If

#### 4.3 High Pressure Gas Holders - continued

the utility avails itself of the above exception, the holder or holders inspected shall be regularly rotated in order that eventually all holders will have been examined.

- (b) In lieu of an internal inspection, when the holder cannot be entered, a sufficient number of plugs shall be cut from, or holes bored in, or non-destructive testing of the shell at points believed most subject to internal corrosion, in order that losses due to corrosion can be determined. The interior of at least one container of holders constructed entirely of pipe and fittings shall be inspected by removing the end closures and entering the container.
- (c) Details of what shall constitute these inspections will be found set forth in the inspection forms prescribed by the Commission. The person or persons making such inspections shall submit a complete report of the condition of each holder to the company and at the same time forward a copy to the Commission. When such holders as are inspected are found to be in a defective and hazardous condition they shall not be returned to service until repaired and placed in a safe workable condition, and all others in the same group shall immediately be inspected and repaired if found necessary. If any portion of the shell of a high pressure holder is located underground and exposed to the soil, inspection of its exterior for soil corrosion and leaks shall be made by suitable representative excavations at the time of inspection.
- (d) In the years that the inspections described above are made, the utility will not be required to make the regular annual general inspection.

#### 4.4 High Pressure Liquid Hydrocarbon Vessels

a. The following minimum inspections shall be made and recorded:

1. Monthly:

Check by actual operation the working condition of all valves, regulators, and other automatic equipment, except relief valves. Observe and note indications of leaks in above ground piping, connections, manholes, and fittings attached to vessels. Inspect and operate drips. Determine if combustible materials are stored within ten feet of vessel, also if relief shutoff valve (if any) is locked open. Check operation and condition of safety shutoff control on vaporization heating equipment.

#### 4.4 High Pressure Liquid Hydrocarbon Vessels - continued

- (a) Check liquid level gauging equipment.

#### 2. Annual General Inspection:

General inspection of above ground vessels for condition, indications of corrosion, and need of painting. Check yard for cleanliness and fencing.

- (a) The exposed piping, valves, and fittings of buried vessels shall be examined for general condition and need of painting. The utility should satisfy itself that vessels are not settling and thereby causing undue strain on the piping and fittings attached thereto. All exposed connections, manholes and fittings on vessels, as well as all mechanical joints in all exposed piping within fifty feet of any vessel, shall be tested for leaks with soapsuds. All leaks and their disposition shall be shown on the report form. Known or suspected leaks on buried vessels, connections, and fittings shall be uncovered and repaired as soon as practicable. Hazardous leaks shall be repaired at once.
- (b) Examination shall be made of foundations and supports for all above ground vessels to ascertain if all saddles and piers are fully supporting the vessel. Any settlement which will produce uneven and excessive strain should be corrected at once.
- (c) Check accuracy of liquid gauging equipment. Check operation of vaporizer relief devices. Inspect condition and operation of safety shutoff control on vaporization heating equipment.

#### 3. Inspection for Soil Corrosion:

Where a storage vessel is underground and exposed to the soil, inspection of its exterior for soil corrosion and leaks shall be made by suitable representative excavations at least once each ten years.

#### 4. Additional Inspections:

Except as hereinafter provided, after a vessel has been used for the storage of liquid hydrocarbons for a period of twenty years and at intervals not exceeding twenty years thereafter, a complete and thorough internal and external inspection shall be made and reported upon by competent outside inspectors, not regularly in the employ of the utility who are selected by the utility and are agreeable to the Commission, with the following exception: At locations where groups of two or more vessels, of the same type of materials and design, built at the same time and subjected during the

#### 4.4 High Pressure Liquid Hydrocarbon Vessels - continued

interval to identical service conditions, exist, no less than twenty per cent, nor less than one of the vessels in any such group shall receive the internal inspection after each twenty years of service. If the utility avails itself of the above exception, the vessel or vessels inspected shall be regularly rotated in order that eventually all vessels will have been examined. When the vessel is buried and/or cannot be entered for an internal inspection, a sufficient number of plugs shall be cut from, or holes bored in, or non-destructive testing of the shell at points believed most subject to internal and/or external corrosion, in order that losses due to corrosion can be determined.

- (a) Details of what shall constitute these inspections will be found set forth in the inspection forms prescribed by the Commission. The person or persons making such inspections shall submit a complete report of the condition of each vessel to the company and at the same time forward a copy to the Commission. When such vessels as are inspected are found to be in a defective and hazardous condition they shall not be returned to service until repaired and placed in a safe workable condition, and all others in the same group shall immediately be inspected and repaired if found necessary.
- (b) In the years that the inspections described above are made, the utility will not be required to make the regular annual general inspection.

#### PART V - RECORDS

##### 5.1 Record of the History of the Operation and Repair of Gas Holders and Vessels

Each utility shall prepare and submit to the Commission a report, not later than January 31 of each year, detailing the construction, disposal, acquisition or installation of any holder or vessel, as well as any change of location, appreciable repair or remodeling of any such equipment taking place during the previous calendar year. These reports shall constitute the Commission's permanent record of all gas holders and vessels.

ATTEST:

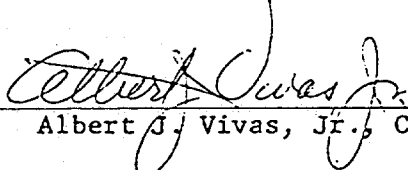
I, ALBERT J. VIVAS, JR., CHAIRMAN OF THE PUBLIC UTILITIES COMMISSION OF THE STATE OF HAWAII, do hereby certify that the foregoing is a full, true and correct copy of Rules and Regulations covering "STANDARDS FOR GAS SERVICE IN THE STATE OF HAWAII," effective October 1, 1965, the original being on file in the office of the Commission.

I do further certify that public hearings for the promulgation of said Rules and Regulations were held as follows:

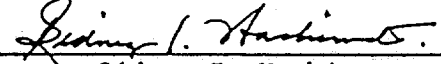
Lihue, Kauai -----	2:00 P.M. March 15, 1965
Kaunakakai, Molokai -----	9:30 A.M. March 17, 1965
Kahului, Maui -----	2:30 P.M. March 17, 1965
Hilo, Hawaii -----	10:30 A.M. March 19, 1965
Honolulu, Hawaii -----	10:00 A.M. March 24, 1965

That written notices were served on all known persons in interest; that newspaper notices were published in the HONOLULU STAR-BULLETIN on February 23, 1965.

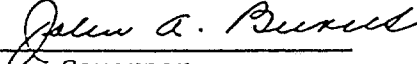
Further, that the foregoing Rules and Regulations covering Standards for Gas Service in the State of Hawaii were adopted at an adjourned session of quorum meeting held at Honolulu, Hawaii on September 8, 1965, Chairman Albert J. Vivas, Jr., and Commissioners Harry Y. K. Chock, Sadao Kon, David S. De Luz and John B. Fernandes being present and voting.


  
Albert J. Vivas, Jr., Chairman

APPROVED:

  
Sidney I. Hashimoto  
Director of Regulatory Agencies

The foregoing Rules and Regulations are hereby approved.

  
Governor  
State of Hawaii

1965 SEP 21 PM 3 30  
REC'D. BY   
LI. GOVERNOR'S OFFICE